Application/Control Number: 10/808,804

Art Unit 1745

Answer to first office action.

(A) Preliminary comments

Rejection under 103 (a).

Examiner correspondence reads in part: *Claims 1-12 are rejected under 35 USC 103(a) ad being unpatentable over Jain et al in view of Bolme or Herbrechtsmeimer et al or Lassman et al, further in view of either of Tamoty et al, even further in view of either Sheu et al '950 or Sheu et al '125, still further in view of Larue at al. Jain et al disclose a process for removing nitrogen oxides from a gas stream (see abstract), and disclose at col. 4, lines 17-26 that the scrubbing liquid may be a basic solution such as the alkali metal or alkaline earth metal hydroxides.*

1. Difference in means (liquid vs solid)

Jain, Bolme, Herbrechtmeimer, Lassman, Tamoty, and Larue all disclose or claim a method for the removal of NO_x from a gas stream using either an aqueous or non aqueous scrubbing solution.

The difference between the object of this invention and Jain, Bolme, Herbrechtmeimer, Lassman, Tamoty, and Larue, lies in the fact that in this

invention a solid form of the absorbent rather than a liquid one is used. This make the filter system more versatile for industrial and research use since no liquid and no plumbing is needed to make it work.

The motivation of the rejection: "*It would be expected from Tamoty et al that nitrogen dioxide is readily soluble in certain scrubbing solutions such as sodium hydroxide, but nitric oxide is not very soluble in most aqueous solutions.*" Has no place since the mechanism of this invention is NOT based on the difference of the solubility between nitrogen monoxide and the impurities in a solvent, rather on the differences in freezing point and chemical absorption on a solid mixture containing hydroxides of alkali and earth alkali metals.

2. Difference in temperature range (i.e. low T vs room T)

In addition to that the combination of a relatively low temperature of operation combined with the absorbent properties of the mixture of alkali and earth alkali metals make the process more effective. It would be impossible to use a solution at such low temperatures because the liquid would freeze. Herbrechtmeimer discloses that for industrial applications up to 17 stages are needed to reduce the level of the impurities in NO below 0.2%. In this invention I claim that impurities can be removed in a single stage from the flow of nitrogen monoxide.

At low temperature the mechanism of removal of most impurities is a combination of freezing and absorption rather than solubility in a solvent and the eventual reaction with a chemical contained in the solution. So there would not

be any suggestion or motivation for one of ordinarily skill in the art to modify and or combine the references in order to make them work at low temperature where most of the solution will freeze.

The quoted patents clearly do not teach the same temperature limitations present in this invention. As disclosed in the summary this invention works best at about 150 K (-123.85 °C) because most of the impurities freeze while NO having a freezing point of 109 K (-163.3 °C) and boiling point of 121.4 K (-151.7 °C) does not freeze or condense. Jain has an optimal temperature of operations between 50 °C and 150 °C. In Bolme, claim 19 °C the process is carried out at room temperature. Herbrechtmeimer teaches a temperature of operation between 0 °C and 50 °C, and suggest optimal conditions of operations between 10 °C and 40 °C. Lassman disclose a temperature of operation between 0 °C and 100 °C, indicating the optimal range of operation between 10 °C and 30 °C. Tamoty describes an invention that works between 10 °C and 50 °C degrees. Both Sheu '125 and Sheu 950 teach a temperature of operation between -50 °C and 300 °C with optimal results achieved between 0 °C and 100 °C.

3. Difference between a molecular sieve and the teaching of Sheu et al '125 and Sheu et al '950.

Sheu et al disclose a method to remove impurities from a flow of nitrogen monoxide gas by passing said flow trough a zeolite filter. Claim 10 is broader in nature and include but is not limited to zeolites. Molecular sieves can in fact often

consist of aluminosilicate minerals, clays, porous glasses, microporous charcoals, zeolites, active carbons, or synthetic compounds like perovskities. The main advantage of using molecular sieves different than zeolities, is the low manufacturing cost of the invention.

(D) Remarks

The object of this invention, as described, is substantially different from any of the previous patent references quoted in the examiner rejection. It is different from Jain, Bolme, Herbrechtmeimer, Lassman, Tamoty, and Larue because of the means of the absorbent. All references quote liquid scrubbing solution, while in this application a solid mixture is described. It is different from Jain, Bolme, Herbrechtmeimer, Lassman, Tamoty, Sheu '950, Sheu '125 and Larue because of the temperature range of operation. All references work well at temperatures above 273.15 degree Kelvin, the object of this invention works well below 200 K. It is different from Sheu '950, Sheu '125 because Sheu '950 and Sheu '125 disclose the use of zeolites only as molecular sieve while other rougher materials can be used under the teaching of this invention as molecular sieves. The other rejection, mainly formal in nature have been addressed by amending or canceling the claims. Out 20 claims originally presented for consideration 11 are left.